

TITLE PAGE

Title: Development, Implementation, and Evaluation of a Water Quality Trading Program for the Non-Tidal Passaic River Watershed

Watershed: Passaic River Watershed **HUC Code:** 02030103

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- ☒ Studies of Market Based Approaches
☐ Studies of the Hypoxia in the Gulf of Mexico

Project Partners:

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Passaic River Basin Alliance, A Nonprofit Coalition of Wastewater Treatment Plants in the Passaic Basin

New Jersey Department of Environmental Protection

New Jersey Association of Environmental Authorities, A Nonprofit Organization of New Jersey Wastewater Treatment Plants, Water Utilities, Solid Waste Facilities, and Collection System Operators

New Jersey League of Municipalities, A Nonprofit Organization of New Jersey Municipalities

ABSTRACT

This project will develop, implement and evaluate an effective water quality trading program for the non-tidal Passaic River Watershed that adheres to the USEPA Water Quality Trading Policy. The focus of the program will include both point-point source trading and point-nonpoint source trading. Watershed studies have been completed for the Passaic and a TMDL is near completion for waters that are suffering from impairments related to New Jersey's 0.1 mg/l phosphorus criterion. The data collected for these existing efforts will provide a baseline for evaluating the effectiveness of this project.

The watershed contains 19 major point sources. Each may require different level of upgrade to achieve water quality standards (ranging from none to high levels of additional treatment), making a trading program very attractive. An active coalition of municipal wastewater treatment plants, the NJDEP, and a team of experts from Rutgers and Cornell Universities has been assembled to complete this endeavor.

WORKPLAN DESCRIPTION

Introduction

The non-tidal portion of the Passaic River watershed encompasses 803 square miles, with 669 square miles of the watershed in New Jersey and the remainder in New York. Approximately ¼ of New Jersey's population (i.e., two million people) lives in this watershed. Three of New Jersey's twenty watershed management areas (WMAs), WMA 3, 4, and 6, can be found in the non-tidal Passaic River watershed. WMA 3 includes the Pompton, Pequannock, Wanaque, and Ramapo Rivers; WMA 4 includes the Lower Passaic and Saddle Rivers, and WMA 6 includes the Upper and Middle Passaic, Whippany, and Rockaway Rivers. In addition, 23 reservoirs, which provide potable water to the residents of New Jersey, are located within the non-tidal portion of the Passaic River watershed. The Wanaque Reservoir is the largest potable water source in the watershed, and it receives water from diversions of the Ramapo, Pompton, and Passaic Rivers to supply water to the North Jersey District Water Supply Commission and the Passaic Valley Water Commission.

The New Jersey Department of Environmental Protection (NJDEP) recently funded watershed characterization and assessment studies of WMAs 3, 4, and 6 (NJDWSC, 2002). These studies revealed that surface water quality standards for nutrients, dissolved oxygen, pH, temperature, pathogens, metals and pesticides are often exceeded in these three WMAs. As a result, much of the water resources within WMA 3, 4, and 6 have been classified as being impaired. There are 19 wastewater treatment point sources within the non-tidal portion of the Passaic River Watershed that each discharge more than 1.0 million gallons per day (MGD) of treated effluent. According to the NJDWSC (2002) studies, these treatment plants contribute a large percentage of the phosphorus load to WMA 3, 4, and 6. Once the ongoing TMDL study is completed, a better understanding of the exact percentage breakdown between point and nonpoint sources under varying flow conditions will be obtained.

A Total Maximum Daily Load (TMDL) study for phosphorus is being developed for the non-tidal Passaic River reaches that are exceeding New Jersey's 0.1 mg/l phosphorus criteria. Surface water samples have been collected at over 70 sampling stations within the watershed, including the 24 point sources (i.e., 19 major and 5 minor point sources). The TMDL study will identify the locations where there is a need to reduce phosphorus loads within the watershed to achieve water quality standards, and the data presented in the TMDL can be used to identify potential trading opportunities within the watershed.

Description of the Proposed Study Project

Phosphorus loading from point and nonpoint sources within the non-tidal Passaic River Watershed is a serious issue that must be addressed to restore the water quality of the rivers, lakes, and reservoirs within the watershed. Wastewater discharges to waterways that are listed as impaired for phosphorus must meet an effluent limit of 0.1 mg/l, subject to the outcome of the NJDEP "exit ramp" protocol or an approved TMDL. The "exit ramp" protocol requires that an instream study be completed to determine whether phosphorus is a limiting nutrient and whether the designated uses are satisfied. Upgrading wastewater treatment plants to meet an effluent limitation for total phosphorus of 0.1 mg/l would be extremely costly. The industry is also concerned that this treatment may not result in an overall environmental benefit and will yield higher total dissolved solids (TDS) effluent concentrations, higher effluent metals resulting from the metal salts currently used to chemically precipitate phosphorus, and significantly more solids residue (i.e., sludge). This increase in TDS and metals effluent concentrations could make it difficult for the treatment plants to comply with the TDS and metals water quality standards that NJDEP is also aggressively enforcing. The increased sludge production will result in significant increases in annual operating costs. All of these additional costs will obviously have to be passed on to the taxpayers through higher sewer rates. Implementation of a water quality trading

program has the potential to achieve water quality standards at significantly lower costs than upgrading each individual treatment plant.

The US Department of Agriculture (USDA) Cooperative State Research, Education and Extension Service (CSREES) Regional Water Quality Program (RWQP) and Rutgers University, recently convened a forum on nutrient trading opportunities within the US Environmental Protection Agency (USEPA) Region 2. The forum addressed the USEPA Trading Policy, case examples from around the country, and explored the challenges that will have to be addressed to achieve successful trading programs. As a result of this conference, a team was assembled to study trading opportunities throughout Region 2. A follow-up working session was held recently at the Rutgers University EcoComplex to discuss the team's initial findings regarding trading opportunities in New Jersey's Raritan Basin. The meeting was attended by representatives from NJDEP, USEPA, New Jersey Association of Environmental Authorities, New Jersey Farm Bureau, New Jersey Department of Agriculture, RWQP, and several professors from Rutgers University. The meeting participants agreed that water quality trading opportunities exist in New Jersey, and Rutgers University in partnership with other team members, should generate the science needed to pursue these opportunities while working with the various stakeholders of the State to facilitate trades. Although the initial focus of this team was to examine point-nonpoint trading opportunities in the Raritan Basin, this team has reviewed the issues in the Passaic River Basin and believes the situation is ideal for a wastewater point-point trading program for phosphorus and may present opportunities for wastewater-stormwater point-nonpoint source trading, as well. Point sources to be considered for trading opportunities include direct discharges, indirect discharges, and municipal separate storm sewer systems (MS4s).

The goal of this project is to develop, implement and evaluate an effective water quality trading program for the non-tidal Passaic River Watershed that adheres to the USEPA Water

Quality Trading Policy and meets the requirements of NJDEP which will facilitate the implementation of the TMDL, reduce the costs of compliance with the Clean Water Act regulations and establish incentives for voluntary reductions. In the fashion of the Long Island Sound point-point trading project, which has been successful in Region 2 (Kirk, 2003), this project will develop a mechanism for trading that applies to the local needs of the stakeholders, as well as NJDEP's requirements. It is expected that the trading initiative will initially consist of bilateral and multilateral trades between two or more wastewater treatment plants, but other trading scenarios will also be evaluated and implemented if feasible and cost-effective. Point-nonpoint trading opportunities in the Passaic may include transactions between wastewater treatment plants and stormwater sources, where phosphorous credits may be generated from the implementation of an array of stormwater best management practices.

This goal will be accomplished by implementing the following tasks:

- 1) Review the available studies in the Passaic River Watershed to identify potential point-point source and point-nonpoint source trading scenarios for total phosphorus. Examine the ongoing demonstration trading projects throughout the country to identify models that can be adopted for the Passaic River Watershed including reviewing studies, papers, and personal communications with the managers of these programs.
- 2) Evaluate these potential trading scenarios from a scientific perspective to determine if the trades will attain water quality standards for total phosphorus, where applicable. The available water quality models used to develop the TMDL will be applied to examine the effect of the various trading scenarios and identify the scenarios that would attain water quality standards.
- 3) Evaluate the economics associated with the various trading scenarios and various trading market structures such as exchange markets, bilateral negotiations, water quality clearinghouses, and sole source offsets as described in Woodward et al. (2002). A bio-economic chance-constrained model will be developed that will link the emission, transport and delivery processes in the Passaic River Watershed with geographically distributed firm-level marginal abatement costs, the objective of which will be to quantify the theoretically attainable cost-minimizing trading opportunities relative to less efficient designs including the status quo of non-trading.
- 4) Evaluate the public policy and legal aspects, including permitting and enforcement implications, of water quality trading as it pertains to the Passaic River Watershed and New Jersey statutes, regulations and policies.

- 5) Develop and implement a trading program for the Passaic River Watershed based upon Tasks 1-4 including facilitating trading negotiations, recommending modifications to NJPDES permits, development of a Quality Assurance Project Plan for a monitoring program to: i) provide the basis to document the improvements to water quality by monitoring in-stream and discharge quality, ii) assess whether the target pounds to be removed is achieved more cost-effectively through the trading program, and iii) document broadened stakeholder engagement.
- 6) Implement the monitoring program to document the success of the trading program. Chemical, biological, and physical data for parameters measured as part of the TMDL study will be collected and compared to the baseline data collected as part of the TMDL study. Particular attention will be paid to instream and effluent phosphorus concentrations, instream dissolved oxygen fluctuations, algal growth, and the health of the macroinvertebrate communities.
- 7) Report results at local, regional, and national meetings and in peer-reviewed journals and extension fact sheets.
- 8) Beyond the scope of the initial project, we will continue to monitor the progress of the trading program. If necessary, we will make modifications to optimize overall program effectiveness or make recommendations to optimize established trading relationships.

Project Team

Dr. Christopher Obropta, Assistant Professor with the Department of Environmental Sciences, Cook College, Rutgers University and Extension Specialist in Water Resources for Rutgers Cooperative Extension will lead the project team. Dr. Obropta prepared the point-nonpoint source trading feasibility study for the Raritan Basin and has led the Rutgers effort in New Jersey on trading issues. Prior to joining Rutgers 1½ years ago, Dr. Obropta was an environmental consultant where he conducted water quality modeling studies for developing wasteload allocations for point sources in New Jersey, conducted TMDL analyses, negotiated NJPDES permits for point source discharges, and designed stormwater management best management practices for nonpoint source pollution control. Dr. Obropta's abilities as a scientist and engineer will allow him to lead the scientific effort to develop a cost-effective trading program, and his abilities as an Extension Specialist will allow him to work closely with various stakeholders to disseminate the information generated by this project.

Dr. Peter Strom, Professor with the Department of Environmental Sciences, Cook College, Rutgers University will provide expertise in wastewater treatment plant processes, including technology for phosphorus removal. Dr. Christopher Uchrin, Professor with the Department of Environmental Sciences, Cook College, Rutgers University will provide expertise in water quality modeling. Drs. Strom and Uchrin conducted a water quality study on the Passaic River in the early 1980s; their previous experience with the watershed will be very valuable to the project.

Dr. William Goldfarb, Professor of Environmental Law in the Department of Environmental Sciences, Cook College, Rutgers University will provide the legal expertise needed to clearly evaluate the various trading scenarios and the trading program as a whole. He has been teaching environmental law and policy in New Jersey for nearly thirty-five years. During the 1970s, Dr. Goldfarb, as a special consultant to NJDEP, drafted the New Jersey Clean Water Act, the New Jersey Safe Drinking Water Act, and the New Jersey Water Quality Planning Act, which were subsequently enacted into law. He is the author of a standard text on water resources law (Water Law, Second Edition, 1988), and is one of the authors of the leading textbook on Environmental Law (Plater, Abrams, Goldfarb, and Graham, Environmental Law and Policy: Nature, Law, and Society (Second Edition, 1998), a Third Edition of which will be published in early 2004. Dr. Goldfarb is one of the Nation's leading academic authorities on water pollution control law.

Dr. Gregory Poe, an Associate Professor in the Department of Applied Economics and Management (AEM) at Cornell University, is active in USEPA's Market Mechanisms program (Poe, 2003a, 2003b) and the of water quality (Bergstrom et al., 2001). Dr. Poe will work closely with Dr. Richard Boisvert, also from AEM, who has longstanding expertise in the estimation of water treatment cost functions and the development of programming models for allocation of

pollutants across watersheds (Jaroszewski et al., 2000), some of which have been previously funded through the USEPA (Boisvert and Schmidt, 1997). Together, Drs. Poe and Boisvert will prepare the chance-constrained model that will link the emission, transport and delivery processes in the Passaic River Watershed with geographically distributed firm-level marginal abatement costs. Concurrent with the development of this model, economists Poe and Boisvert will conduct a thorough review the current literature on the relationship between program design and the relative effectiveness of existing water quality trading schemes in the United States, with specific attention given to the issue of why few nutrient credit trades have occurred (King and Kuch, 2003; Woodward et al., 2002). The model will also be used to account for any institutional and other real-world policy constraints (e.g., geographical limitations on trading) appropriate to this pollution trading program.

Mr. Jeffrey Potent is the USDA RWQP Coordinator, the EPA Region 2/Cooperative Extension Liaison and, with Dr. Obropta, initiated the NJ trading project. He will assist in addressing public policy, regulation and project coordination, and include participants in a facilitated regional dialogue on trading. Mr. Potent's time will not be charged to this project.

Mr. Michael Dimino, Acting Director of the EcoComplex - Rutgers University Environmental Research and Extension Center, has extensive experience with the wastewater treatment industry as a former executive director of one of the larger sewerage authorities in New Jersey and working as a consultant to NJPDES permit holders on numerous NJPDES permitting matters. He will assist with negotiating trades between parties and crafting NJPDES permit language that is protective of the trading participants and the environment. As New Jersey moves forward with a trading program in the Passaic River Watershed and other areas of the State, the EcoComplex can serve as a resource clearinghouse to support trading statewide (e.g., providing technical assistance, negotiation support, and monitoring support).

The Passaic River Basin Alliance, a local nonprofit organization, is a coalition of most of the wastewater treatment plants within the watershed. The Alliance has been very active in working with NJDEP to better understand phosphorus issues in the watershed and is very interested in pursuing market based strategies to attain water quality standards. In accordance with a settlement agreement with NJDEP, the total cost of the TMDL Work Plan was funded by the Alliance, and its members funded approximately \$1.4 million of the cost of the TMDL study. The Alliance will work closely as a partner in the project to help negotiate NJPDES permit language, and they will provide critical technical and cost information on specific treatment facilities. Both the New Jersey Association of Environmental Authorities and the New Jersey League of Municipalities will provide outreach and educational support for the project and will work with the team to disseminate information to their constituents.

NJDEP will also play a major role in the project. The NJDEP staff responsible for TMDL implementation, NJPDES permitting and enforcement will work closely with the project partners to ensure that the results of the program satisfy all relevant regulatory requirements, and the NJDEP economics staff will work with the project partners to evaluate the program's economic impacts and cost-effectiveness. NJDEP will also be responsible for developing the education and outreach program for the project, and Rutgers Cooperative Extension and the EcoComplex staff will assist the NJDEP in implementing this part of the overall program. The EcoComplex's state of the art conference facilities will be available as a tool for outreach to the public.

Project Timeline

Tasks & Milestone completed at the end of Year 1

- Task 1: Review the available studies to identify potential trading scenarios
- Task 2: Evaluate the potential trading scenarios from a scientific perspective
- Task 3: Evaluate the economics associated with the various trading scenarios

- Task 4: Evaluate the public policy and legal aspects of pollutant trading
- Milestone 1: Prepare a report documenting the identification and evaluation of potential trading scenarios and a recommended trading structure for the Passaic River Watershed.

Task & Milestone completed at the end of Year 2

Task 5: Develop and implement a trading program

Milestone 2: Development and implementation of specific trades. This will include amended NJPDES permits for the point sources.

Tasks & Milestone completed at the end of Year 3

Task 6: Implement the evaluation step and monitoring program to document the success of the trading program

Task 7: Report results

Milestone 3: Documentation of the success of the trades through cost-effectiveness evaluation and monitoring activities.

Project Budget

Personnel: Each of the seven faculty team members will receive one month of summer salary for each of the three project years (\$210,000) and will match with one month of salary time each year. NJDEP will also provide an in-kind match of personnel time. A project manager will be hired for the three-year project (\$150,000). Rutgers Cooperative Extension staff has been allocated to each year of the project to assist with the outreach portion of the project (\$75,000). Two graduate students will be fully funded for each of the three years (stipends/salary = \$97,812; student tuition remission = \$52,440). A part-time secretary will be assigned to the project for each year (\$45,000). Hourly students will be hired to assist with the project (\$25,000). The Passaic River Basin Alliance will establish the cost differential between removing phosphorus at each of the major wastewater treatment plants at varying levels of control (\$4,000 per major wastewater treatment plant, or \$76,000).

Fringe: There is no fringe associated with summer salary for the seven faculty team members. There is 29% fringe benefit cost associated with the project manager and Extension staff. The fringe for the graduate students is 18½%. The fringe for the part-time secretary is 8½%. There is no fringe associated with hourly student labor in Year 3 of the project.

Travel: Travel to local meetings, regional meetings and annual conferences for all three years (\$22,500).

Equipment: YSI DO/pH/Temperature Meters and data loggers (\$12,000)

Supplies: Computers for project manager and two graduate students (\$7,500) and software for these computers (\$1,500). Laboratory/field equipment for monitoring program (\$10,000). Computer service fees are required for network maintenance and technical support for the three year project (\$10,500). Copying costs are estimated for the three year project (\$9,750). Telephone charges are also included in the budget (\$3,000).

Contractual: Funding has been set aside to support the effort of the consultants that performed the original modeling for the Passaic River TMDL Study. These consultants will assist in modeling efforts to evaluate the various trading scenarios (\$100,000). Funding has also been allocated for laboratory analyses of water quality samples during the monitoring program (\$75,000).

Other Costs: Tuition remission for Graduate Students \$52,440.

Indirect Costs: The standard off-campus indirect rate is 26%.

Requested Funds: \$1,278,621

In-Kind: \$ 418,098

TOTAL BUDGET: \$1,696,719

Description of Project Management

As discussed earlier, Dr. Obropta will be ultimately responsible for managing the project. As the Principal Investigator, Dr. Obropta is currently managing a \$1,000,000+ NJDEP grant for a TMDL Advisory Panel that provides technical support to the State to develop TMDL modeling and implementation methodologies. Drs. Goldfarb, Strom, and Uchrin are also members of the TMDL Advisory Panel. He is also managing several smaller 319(h) grants to develop Regional Stormwater Management Plans. Dr. Obropta has a technical support staff consisting of five full-time program associates with a wide range of expertise. He consistently provides deliverables on-time and within budget, and the Office of Research Programs at Rutgers University has an excellent reputation for assisting faculty with effectively managing large grants.

Description of Outreach Activities

As part of the statewide watershed initiative that began five years ago, the NJDEP has an extensive public participation process in place. The NJDEP Office of Education and Outreach will develop an outreach plan that uses the existing process to engage local stakeholders through regular meetings, newsletters, fact sheets, and various mailings. Rutgers Cooperative Extension, with an office in each county, will provide support to NJDEP in implementing the outreach and education program. In addition to NJDEP and Rutgers Cooperative Extension, Mr. Jeffrey Potent will provide outreach and education efforts to engage stakeholders throughout USEPA Region 2 and the EcoComplex will be available to use for the various outreach activities.

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